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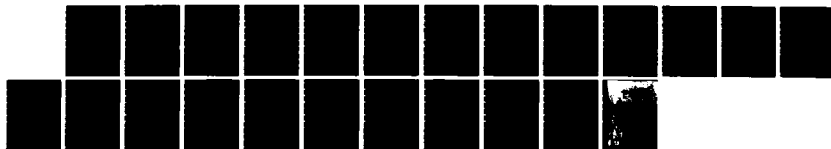   SYSTEM PLAN(U) HASSELGREN (P) INC TROY NY P HASSELGREN
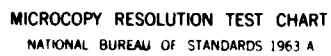   06 FEB 84 DAAA22-83-C-0139

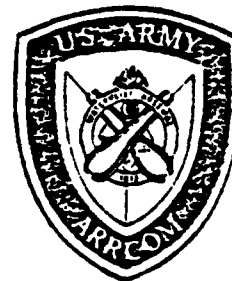UNCLASSIFIED   F/G 5/2   NL

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WATERVLIET ARSENAL

OFFICE OF THE COMPTROLLER

A STUDY TO EVALUATE WATERVLIET ARSENAL'S BUSINESS SYSTEMS PLAN

AD A140055

FINAL TECHNICAL REPORT

FEB. 6, 1984

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PREPARED UNDER CONTRACT N.O.

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

The report develops and proposes a concept of operation for the Arsenal's Information System which includes:
.Greater user participation in, and responsibility for, Information System design and development;
.Sharing information via the use of an integrated data base;
.Using teleprocessing systems to speed up the input/output/data manipulation process;

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Providing computational capability to users to support their data analysis needs on a timely basis.

To implement the concept specific recommendations are presented covering (1) the division of responsibilities among participants (2) staffing requirements (3) hardware (4) current system inaccuracies (5) priorities (6) office automation and (7) the use of small computers.

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February 6, 1984

Col. E. V. Karl
Commander
Watervliet Arsenal
Watervliet, New York 12189

Dear Col. Karl:

   This is the final report under Contract DAAA-22-83-C-0139, which is the result of work conducted at the Arsenal during the period February 7, 1983 to February 6, 1984. Interim .Technical Reports were rendered during the course of the engagement on May 9, August 8, and November 7, 1983.

   I would like to formally thank the personnel at Watervliet for the courtesies extended to me and their excellent cooperation in this effort.

   If you, or any of your staff, have any questions regarding this report, I am more than willing to provide the necessary explanations..

Very truly yours,

P. HASSELGREN

FINAL REPORT

The purpose of this report is to present the final results of my review of the Arsenal's Business Systems Plan (BSP). The review was performed at Watervliet Arsenal, Watervliet, New York during the period February 7, 1983 through February 6, 1984.

1. ENGAGEMENT OBJECTIVES

The objectives of the engagement were to:

- Assess the adequacy of the Arsenal's current resources and division of responsibilities to successfully implement the BSP.

- Develop recommendations as to modifications that should be made to current information system (IS) plans and programs to enhance their cost effectiveness.

- Develop an implementation plan to activate accepted recommendations.

2. STUDY APPROACH

The approach used to accomplish these objectives was to attend briefings, conduct interviews and study the BSP and other written material, such as organization and function statements, pertinent regulations, staffing patterns and special studies with the objective of obtaining an overview of the Arsenal's IS activities. The study of available written material was supplemented by the gathering of additional data considered relevant.

The initial objective was to develop a concept of operation which would overcome the limitations of the current IS as outlined in the BSP. We then concentrated on identifying impediments and resource shortfalls which would inhibit employment of the concept.

- Briefings - We attended briefings with the primary objective of obtaining an understanding of information needs of the various Arsenal organizations and the availability of data processing resources.

- Written Materials - We obtained and reviewed the BSP, organization and functional statements, regulations, Tables of Distributions and Allowances, position descriptions, special studies and financial reports to supplement the information obtained in our briefings.

- Interviews - We conducted interviews with representatives from the following Arsenal organizations:

- Commander
- Management Information Systems Directorate
- Comptroller
- Operations Directorate
- Procurement Directorate
- Product Assurance Directorate
- Facilities Engineering Directorate
- Civilian Personnel Office
- Force Development Office
- US Army Communications Command - Watervliet Arsenal Detachment

The objective of these interviews was to obtain a better understanding of the role of each of these organizations in the Arsenal's data processing activities and an appreciation of their individual needs for improved information.

3. OBSERVATIONS AND RECOMMENDATIONS

We had a number of observations and recommendations which we believed warranted management's attention. The observations and recommendations were

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informally presented to senior management as they were developed; they were also subsequently included in three interim technical reports rendered during the course of the review. In each instance the recommendation has been accepted and management has initiated implementing action.

The observations and recommendations are summarized by ten categories: (1) Business Systems Plan, (2) Concept of Operations, (3) Division of Responsibilities, (4) Staffing, (5) Hardware, (6) Coordination and Integration, (7) Information System Inaccuracies, (8) Business System Plan Priorities, (9) Office Automation, and (10) Small Computers. In addition, this report includes a summary observation on the development of the Arsenal's Information System.

(1) Business Systems Plan

The major thrust of the Business Systems Plan was to establish an information systems architecture and priorities within the areas of Production, Procurement and Quality. The BSP Report recommended that the Director of Management Information Systems develop an action plan to address the architecture and priorities. The Report commented on the user's general dissatisfaction with their current information systems, at the same time indicating that the centralized MISD organization was cooperative and was doing the best job it could within its currently available resources.

The Report implied that the Arsenal's senior management had a strong desire to capitalize on the technological revolution occurring in the IS field in order to accelerate the automation of their information systems. Interviews with senior management personnel confirmed this notion.

In order to effectively capitalize on the new IS technologies a number of more fundamental management issues needed to be resolved prior to

developing an action plan to implement the systems architecture and priorities. The most important of these issues were:

(a) Developing a concept of operations which employed the new IS technologies to overcome current limitations.

(b) Defining the division of responsibilities for information systems between MISD and the user organizations.

(c) Defining staffing, both in terms of numbers and skills, needed to support a realignment of responsibilities.

(d) Defining hardware requirements.

(e) Determining the mechanisms needed to coordinate and integrate user and MISD efforts.

(f) Defining the inaccuracies in the current information systems and developing a plan of corrective action.

Our observations and recommendations on these issues were as follows:

(2) Concept of Operations

A review of the BSP provided an insight into most of the limitations of the existing IS process. The BSP identified limitations were:

- Major Arsenal business processes and decisions were not being accommodated.

- The majority of Management Information Systems Directorate (MISD) systems and programming resources were required just to maintain existing systems.

- There was a pent up management desire to accelerate additional IS applications.

- Users ability to access and manipulate available data was severely limited.

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- There were extensive redundancies in existing IS data.

- The existing system did not provide for data sharing via terminals, nor was any computer processing capability distributed to the users.

My review revealed that an additional limitation of the existing IS process was that user specifications for new or modified systems were generally inadequate.

All of the above suggested a concept of operations which required:

- Much greater user involvement in, and responsibility for, IS design and development.

- Sharing information via the use of an integrated data base.

- Using teleprocessing systems to speed up the input/output/data manipulation process.

- Providing computational capability to users to support their data analysis needs on a timely basis.

It was recommended that the concept of a shared IS network with decentralized design, access and computational capability, but with centralized processing, coordination, and control be adopted by the Arsenal. This mode of operation provided the greatest promise of satisfying the above stated requirements. The concept of a shared IS network with the features recommended was accepted by Arsenal management.

(3) Division of Responsibilities

The division of responsibilities necessary to implement the shared IS network concept were broadly outlined as follows:

MISO

- Coordination of total IS effort

- Programming Data Base Systems

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- Assuring Integration of the Data Base

- Control of Data Base Integrity

- Provision of Hardware/Software

- Processing

Users

- Preparing Systems Specifications

- Programming for Information Retrieval/Analysis

- Programming User Unique Systems (with Prior Approval of MISD)

The above assignments required the assumption of new and expanded responsibilities for both the users and MISD. As a result of this observation, a new MISD mission and function statement incorporating the recommended changes, has been published.

(4) Staffing

The new and expanded responsibilities suggested a need for a realignment and enhancement of IS staffing in both MISD and user organizations as follows:

A. Users - The primary requirement for staffing in user organizations was the development of a systems analysis capability. Ideally, systems analyst personnel should be careerists in the functional area to which assigned, with a broad understanding of their organization's information needs. The systems analysts should be supported by a computer programming capability to permit effective use of the decentralized analysis and programming authority.

Several organizations such as the Operations and Facilities Engineering Directorates, the Comptroller, and the Civilian Personnel Office already had "user cell" staff in place. In general, the existing

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complement of personnel assigned to these functions appeared adequate for their stage of development. The Operations Directorate had 13 personnel authorized to cover the Manufacturing, Production Planning and Control, Quality Control and Supply functions. Given the magnitude of the Directorate's IS needs as outlined in the BSP, and the proposed added responsibilities, it was recommended that additional staffing be considered.

For those organizations which had not yet staffed their "user cells" such as the Procurement and Product Assurance Directorates, their planned initial authorization of 3 personnel·each seemed appropriate.

The Arsenal has 14 smaller organizations whose size did not seem to warrant a separate IS staff. It was recommended that the IS needs of these organizations could best be served by the establishment of a small centralized IS staff which would be assigned to assist these organizations as needed.

These observations led to the increase in authorized staffing in the Operations Directorate to a new total of 36 personnel. Also, an Administrative Data Systems Section was established within the Comptroller's Office with an authorized staffing of 3 people to provide the support recommended to the 14 small Arsenal organizations.

B. MISD

The existing MISD organization required realignment and enhancement in order to properly discharge their proposed responsibilities under the IS network concept. Shared data, with a decentralized inquiry and manipulation, requires a more extensive systems programming capability than currently existed. In addition to developing and maintaining sophisticated operating systems software, it will be necessary to establish and maintain a system to effectively control the integrated data base within the IS hardware.

The anticipated rapid expansion in demand for remote data processing devices (terminals, printers, etc.) will require that a hardware expertise be developed to insure both the cost effective acquisition and technical compatibility of the devices within the network environment. It was believed that these new and expanded technical demands warranted the establishment of a separate organizational entity within the Directorate.

The functional statement for the MISD Planning Division did not include the new management responsibilities necessary to coordinate and integrate network activities, nor was there any provision for establishing and maintaining a quality assurance/quality control capability necessary to assure the integrity of data entering the system. Network users will be totally dependent on the integrity of shared data and should have reasonable assurance that the information is of sufficient quality that it can be relied upon to support their decision-making process. It was recommended that the Director, MISD, determine the additional staff and skills required to adequately discharge these proposed responsibilities.

As a result of these observations the personnel authorization for MISD was increased from 47 to 56. A new Resource and Techniques Division was established to provide the necessary technical capability for the acquisition and maintenance of hardware, software, and information structures, as well as to provide a systems programming capability. The MISD Planning Division has been redesignated as the Planning and Control Division with the additional responsibilities of:

- Maintaining an Arsenal-wide plan for IS automation

- Coordinating IS efforts to develop an integrated data base, and

- Developing a system of controls to assure data base quality.

Action to recruit the additional authorized personnel was initiated in March 1983.

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The new Resource and Techniques Division is now fully staffed. The revised Planning and Control Division is still not fully operational because of significant delays encountered in recruiting new personnel. The delays are attributed to both the limited availability of qualified people, and to slow processing by the Office of Personnel Management (OPM).

(5) Hardware .

Prior to 1981 the Arsenal's business computer workload was being processed at t.. Northeast Computer Center (NECC), Fort Monmouth, New Jersey. As a result of the Center's limited expansion capability and deteriorating service, the Arsenal justified the acquisition of its own in-house computer. An IBM 4331 mainframe computer with one megabyte of core storage was installed at the Arsenal during January 1981.

The mainframe was upgraded in December 1981 to accommodate 2 megabytes of core storage and, during the review period, was again upgraded to its maximum capacity of 4 megabytes.

Transfer of the data processing workload from NECC to the Arsenal was accomplished over an 18 month period ending in June 1982.

During March 1982 MISD acquired and installed a software package called User Files On Line (UFO), which created the capability for on-line programming from remote terminals.

The acquisition of its own mainframe, transfer of its workload from NECC, and the addition of the UFO software were all essential to allowing the Arsenal to proceed with developing the proposed IS network.

The Arsenal had been operating within a centralized data processing mode with limited on-line processing. At the outset of this review the mainframe was supporting a complement of 34 on-line devices used solely for remote input/output purposes. There was no user remote programming being accomplished.

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The Comptroller was planning to go on-line with a Cost Accounting
System which was a strong candidate for data sharing because of the wide-spread
use of this information throughout the Arsenal. It was recommended that the Cost
Accounting application be used as the prototype for the shared data/on-line
programming concept, and that Cost Accounting's major customers (the Arsenal
Operations, Procurement, Product Assurance and Facilities Engineering Directorates)
utilize or acquire on-line terminals to take advantage of the information to be
made available to them in this new mode. Subsequently, all the organizations
mentioned and the Benet Weapons Lab acquired on-line capability and are now
accessing Cost Accounting's data base information.

In general, the existing hardware configuration was adequate to pursue
the new concept, but a substantial increase in terminal devices would be necessary
to maximize the advantages to be gained from shared data. Terminals for remote
input/output use were being justified and acquired by users on a piecemeal basis.
Within the framework of the IS network concept, a consolidated justification
and acquisition to satisfy total Arsenal needs was recommended as a more cost
effective approach which would also facilitate assurance of technical compatibility.

This recommendation has been implemented. MISD is now assembling
user requirements in order to forward consolidated proposals to higher headquarters
for IS equipment acquisitions.

The IBM 4331 was soon to be configured to its maximum capacity. The
minimum lead time for justification, acquisition and installation of a new
mainframe is 15 months. A rapid acceleration in the automation of the Arsenal's
information systems could be expected from implementation of the proposed concept.
It was therefore recommended that MISD immediately commence planning for the
acquisition of a new mainframe adequate to support the IS network requirements
in the 18-month to 5-year forward time frame.

Subsequent to this recommendation MISD prepared a justification to replace the IBM 4331 with a new mainframe configuration which should satisfy Arsenal requirements for the next two years. The justification has been forwarded to higher headquarters for approval. Planning for future mainframe capacity will now be an ongoing MISD process.

(6) Coordination and Integration

The decentralization of systems design and user unique programming responsibility throughout the Arsenal places a premium on establishing a strong centralized coordination and integration capability within MISD. Functions which should be assigned to this organization to assure a fully coordinated IS approach include:

- Establishment and maintenance of an overall Arsenal IS Plan.

- Review of requests for establishment of user unique systems to assure the information is not required by other network participants.

- Coordination of multi-organization system establishment and system change proposals.

- Coordinating the establishment of Arsenal IS priorities, based upon a maximum overall benefit criteria.

- Inventorying and cataloging all existing manual and automated data bases. Developing a data element dictionary.

- Reviewing systems specifications for adequacy and completeness.

- Advising and assisting user cell members regarding training opportunities and appropriate system development techniques.

- Establishing appropriate quality assurance plans and quality control techniques to insure the integrity of data base information.

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It was recommended that MISD incorporate the above functional assignments in a revision to its formal mission and functional statements. The recommended action was completed during the course of the review.

In addition, it was recommended that MISD establish and chair an Information Systems Network Committee, with representation from each of the user cells and from the USACC detachment at Watervliet. The committee was to serve as the forum for addressing and resolving common network issues. Such a group would also facilitate the timely interchange of information and plans among network participants.

The committee has now been established under the chairmanship of the Chief, Automation Planning & Control Division, MISD and is currently meeting bi-monthly.

(7) Information System Inaccuracies

The BSP stated that existing information was inaccurate, inconsistent and contained unwarranted redundancies. No further detail of these limitations was provided.

Available evidence suggested that many of the inaccuracies in existing automated systems were caused by inaccuracies in source data documents. If quality data bases are to be achieved, the root cause of the inaccuracies must be determined, and a plan of action to overcome the deficiencies developed. While the proposed IS concept holds great promise for reducing or eliminating inconsistencies and redundancies, it will not alleviate the problems of inaccuracy; if that problem is caused by poor source data.

It was recommended that MISD prepare an analysis of the existing inaccuracies, including an evaluation of their impact on the approximately 1400 automated data outputs. Upon completion, the analysis should be used to develop a plan of action to reduce or eliminate the current deficiencies.

As an initial step to implement this recommendation MISD developed
a matrix to relate report outputs to source documents. As MISD Planning and
Control Division personnel are recruited and trained, plans will be developed to bring
about data integrity through the elimination of existing inaccuracies.

(8) Business Systems Plan Priorities

The BSP Report contained two major thrusts. The first being the
establishment of an information systems architecture and priorities within the
areas of Production, Procurement, and Quality. The second being the identification
of limitations and shortcomings of the then information systems process, which
was addressed earlier in this report.

The BSP architecture is represented as a matrix depicting the information
systems required to support the Arsenal's major business processes. From this
architecture, priorities for information systems development were proposed,
based on the systems potential benefits, impact on Arsenal operations, probability
of success and relevancy to the Arsenal's management decision process. The
recommended order of priority for systems development was

- Control of In-Process Production

- Purchasing

- Quality Management

- Materials Requirement Planning

- Inventory Management

- Production Scheduling

- Product/Workload Forecast

- Manufacturing Planning and Estimating

The priorities recommended were subsequently reviewed and approved by
the Arsenal Executive Board and the Commander. Although the priorities were

proposed under a more centralized information system than is now being developed under the IS network concept, the priorities are equally as valid today as when formulated. However, decentralization of the responsibility for developing detailed user specifications will materially reduce the competition for resources at the early stages of systems development. Thus, the development of a number of desirable administrative systems covering personnel, financial, plant facilities and similar activities can proceed without conflict. The priorities need only come into use when there is competition for common resources. It was, therefore, recommended that the BSP priorities be used by MISD for the resolution of any conflict in the use of information system resources. The Director, MISD, agreed with this recommendation.

(9) Office Automation

The establishment of the IS network with widespread use of data processing terminals linked to the MISD mainframe computer presents opportunities to extend the system to office automation applications such as word processing and electronic mail. Given sufficient mainframe capacity, there are currently available software packages which would allow such applications using essentially the same hardware required for data processing activities. The obvious advantage of using existing hardware along with uniform software packages holds considerable promise as the most cost effective approach to satisfying Arsenal office automation requirements. Lacking such an approach it can be anticipated that there will be a proliferation of incompatible office automation equipment and software, with the attendant problems of high cost and lower productivity, as operators would require retraining whenever reassigned from one system to another. At present, the IBM 4331 mainframe does not have sufficient capacity to process these additional systems. However, it was recommended that MISD insure that these potential applications be considered in their planning for the next mainframe computer upgrade.

As a first step in providing office automation type programs to network participants MISD has included a provision for an electronic spread sheet program in its justification to upgrade the IBM 4331 mainframe.

(10) Small Computers

The Arsenal has very limited experience with the use of desktop or micro-computers. As of August 1983 there were only two on hand, both located in the Arsenal Operations Directorate. However, action was in process to acquire a micro-computer for each of the Product Assurance Directorate, Procurement Directorate, and Comptroller Office. While small computers have the considerable advantage of flexibility and relatively quick start-up times, their uncontrolled use can easily abrogate the advantages to be gained from a shared information systems network. According to a recently released General Accounting Office (GAO) report[1], other federal agencies are experiencing a proliferation in the use of small computers, thereby creating significant management problems. Among the problems cited were:

. Agencies are not considering life cycle costs when acquiring small computers. GAO reports show that software and maintenance costs are significantly higher than the initial investment in hardware. They noted examples where software costs reached ten times that of hardware.

. The accuracy of data on small computers was receiving little or no verification. In a small computer environment there is great potential for using erroneous information.

. The acquisition of multiple types of small computers within the same agency prevented sharing of common software and data files.

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[1]GAO Report B-210716 to Director, Office Management and Budget (OMB), dated March 8, 1983.

. Agencies do not know what applications are on their small
computers. This contributed to redundancy in software development
and loss of control over the information processing function.

. Agencies had few procedures in effect to provide security and
loss of critical data on small computers.

. Agencies do not know to what extent their small computers are
being utilized. GAO found one agency in the process of procuring
$7 million of small computers when 20 small computers it already
had were being used at only 15% of capacity.

. There was a lack of software and documentation standards for
small computers. This resulted in less portable software because it
incorporates vendor unique features and other local variations.

. Few formal software libraries had been established to facilitate
software exchange between user organizations. GAO found one example
where the same application was developed six times by different
user organizations within the same agency.

In the same report, senior ADP officials of user agencies were quoted
as having the following concerns with the use of small computers:

. Protection of proprietary data and compliance with the Privacy Act.

. Ensuring that information maintained in private data bases is
forwarded to upper management.

. Inaccurate data stemming from non-professional programming.

. Incompatibility of both hardware and software

. Control of input and retrieval of data in data bases

. Loss of agency data when programmers leave without providing
documentation.

- Inability of non-professional users to diagnose problems.

- Power struggles between the central data processing organization and small computer users, and

- Inconsistencies between agency goals and user perceived needs for small computers.

The report recommended that OMB formulate policy and issue guidance to Federal agencies for a more informed, controlled, and systematic approach to the justification, installation and operation of small computers.

In order to avoid repetition of the problems being encountered in other Federal agencies, it was recommended that as these organizations acquired their small computers, a committee of users, chaired by a MISD representative, be established. The committee should be chartered to develop proposed Arsenal policies and procedures for the acquisition and use of additional micro computers which take maximum advantage of their unique capabilities while still maintaining essential overall Arsenal coordination and control.

The proposed micro computer committee, chaired by the Chief, Automation Planning and Control Division, MISD, has now been established. The initial meeting was held on November 29, 1983.

(11) Summary Observation

In general, progress in implementing the information systems (IS) network concept has been good, given the constraints of Civil Service recruitment procedures and the availability of qualified personnel. Full implementation of the concept should be viewed as a long-term effort that will be an evolutionary rather than revolutionary process. Most user organizations have their initial staffs in place and appropriate training is being accomplished. The Cost Accounting application is now operational in an on-line mode and can be used as a model for

the development of other shared information applications. Two of the three highest priority BSP applications (control of in process Production and Quality Management) are now operational, and systems design work is in process on the third application (Purchasing).

Recruitment of the additional MISD staff necessary to fully implement the concept has been slow, primarily as a result of the limitations inherent in the Office of Personnel Management's recruitment procedures. Full implementation of MISD's newly assigned responsibilities is necessarily limited by their ability to recruit and train their authorized staff. Meanwhile MISD has been able to adequately support the highest priority network activities and proceed with the most essential aspects of their new responsibilities.

The recent establishment of the Computer Integrated Manufacturing (CIM) Planning Team to develop an appropriate architecture can, and most likely will, have a significant impact on the current IS planning and priorities. Assessment of the impact must await the results of the Planning Team's efforts. The current IS planning will then require modification to assure integration with the new CIM architecture and compatibility of data bases, software, equipment and priorities.

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